THE VEGETATION OF THE CAPE REGION OF BAJA CALIFORNIA

Forrest Shreve

The southern end of the peninsula of Baja California is virtually an island from the biological standpoint on account of its effective isolation from the nearest areas of similar climate. It is separated from the Mexican mainland by the Gulf of California, with an average width of 150 kilometers (93 miles), and from the mesic highlands of northern Baja California by an arid stretch of 550 kilometers (342 miles).

The groundwork of the vegetation of the peninsula is desert. In the north there are two large mountain ranges, the Sierra Juarez and the Sierra San Pedro Martir, with summits clothed by coniferous forest. Between them and the Pacific lies an area of chaparral, desert-chaparral transition and some grassland. Between the mountains and the Gulf of California is the narrow band of desert which connects the continental and peninsular parts of the Sonoran Desert. In the extreme south is another series of mountains, the Sierra Giganta, Sierra Laguna and Sierra Victoria, which reach altitudes of 1800 to 2400 meters (5900 to 7875 feet) and have an area of about 830 square kilometers (300 square miles) above an elevation of 1000 meters (3280 feet). Outside the Viscaíño Desert and the Magdalena Plain the entire surface of the peninsula is rugged or mountainous, and there are a few scattered ranges with small areas above 1000 meters (see map, fig. 1).

The northern mountains and the chaparral region are very regularly visited by winter rains. The southern mountains usually have copious summer rains. In the intervening area, latitude 26° to 30° N., the rainfall is low and sometimes there is none for three or four consecutive years.

The botanist who traverses the peninsula from north to south is impressed by the steady loss of familar plants and the constant appearance of new species throughout the entire distance of 1300 kilometers (800 miles). South of latitude 30° N., in the desert part of the peninsula, there is little change in the physiognomy of the vegetation in spite of the gradual changes in the flora. South of Comondú, at latitude 26° N., the types of vegetation gradually become more numerous and the communities found in different situations and habitats become more unlike each other than is the case in the central region. With the enriched vegetation comes a more rapid change in the flora.

The distinctive character of the fauna and flora of the "Cape Region," or "Cape District," has been shown by Bryant (1), Brandegee (4), Nelson (6), Grinnell (5) and others. Nelson

Madroño, Vol. 4, pp. 105–136, October 4, 1937.

has mapped the life zones of Baja California (6, pl. 32), extending the arid tropical zone northward from the cape to latitude 27° 30′ N., and comprising in the lower sonoran zone the northern part of the central desert region and also the higher elevations of the southern mountains. Grinnell has studied the distribution of the birds of Baja California and has demonstrated strong differentiation centers in the high mountains of the north and of the Cape Region south of La Paz, as well as weaker centers at latitude 27° N. and on the Pacific islands. Brandegee, working over forty-five years ago, made the most thorough botanical exploration of the Cape Region that has yet been carried out and published three papers (2, 3, 4) which must long serve as the foundation for further work in southern Baja California.

During a visit to the southern part of the peninsula in the spring of 1935 I was interested in locating the southern limit of desert plants and desert types of plant communities, in determining the character of the vegetation of the Cape Region, and in comparing the southern edge of the desert with its termination in southern Sonora (7).

South of La Paz the topography of the peninsula is dominated by the Sierra Laguna and Sierra Victoria, which together form a narrow range with seven sharp peaks, steep sides, and outwash slopes which fall at sharp gradients. These mountains are wholly granitic, and the coarse angular character of their eroded material is responsible for the steepness of their detrital slopes and for the broad sandy streamways which pitch down to the sea.

Northward from La Paz the topographic pattern of Baja California is relatively simple for about 250 kilometers (155 miles). In this stretch lies the Sierra Giganta, which hugs the Gulf coast with an unbroken ridge from 500 to 1000 meters (1640 to 3280 feet) in altitude and culminates in a rounded peak of 1766 meters (5775 feet) at latitude 26° 7′ N. The eastern face of the Sierra Giganta is very precipitous, while the western slope falls gradually to the Magdalena Plain. The escarpment which faces the Gulf is genetically related to the similar ones found on the eastern side of the Sierra Nevada, San Jacinto, Cuyamaca, Juarez and San Pedro Martir ranges. With rapidly falling elevation the escarpment crosses the peninsula west of La Paz and runs into the Pacific coast a short distance north of Todos Santos. The numerous drainageways on the west slopes of the Sierra Giganta are responsible for the building of the Magdalena Plain. At present, in a stretch of 200 kilometers there are only five large canyons which discharge their flood waters to the Pacific or the coastal lagoons. The plain is covered with thousands of small playas or dry lakes, which testify to the lack of established drainage. The rock material of the Sierra Giganta is very largely volcanic. Also there are

PLATE XVIII. Looking southeast from a locality 15 kilometers north of Todos Santos toward Victoria. Open forest of *Bursera microphylla, Cyrtocarpa edulis, Cassia atomaria, Pachycereus pecten-aboriginum, Gochnatia arborescens,* and numerous shrubs. In foreground *Lemaireocereus Thurberi, Opuntia cholla, Jatropha spathulata* and *Encelia farinosa.*

volcanic hills immediately east of La Paz and in an irregular series running southward along the Gulf coast, broken between Bahia de las Palmas and Punta Arena del Sur, and terminating in a large area in and around the Sierra de la Trinidad, northeast of San Jose del Cabo.

Southern Baja California, in contradiction to the northern section, receives more rain on the east coast than on the west. There is occasional winter rain west of the mountains, but the summer rains which visit the east coast and the mountains are much more copious and certain. Summer rain also occurs in the Sierra Giganta, in the Sierra de Zacatecas, west of Concepcion Bay, and extends sporadically northward to the mountains of California.

The Cape Region not only has a higher rainfall than the central section of the peninsula but receives it in the most favorable season. To these facts must be attributed the termination or localization of desert and the existence in the Cape Region of vegetation with a higher water requirement. The plant life of the region has developed under conditions of both geographic and climatic isolation. The available geological evidence indicates that these isolating features have undergone little change during most of the period in which the angiosperms have dominated the vegetation of the earth. It would, therefore, be a matter of considerable interest to compare the flora and vegetation of this ancient area with the region of summer rainfall in Sonora and Sinaloa, with the long stretch of desert which it terminates, and with the nearest mesic areas in Baja California. Such a discussion of the relationships of the flora will have to await a much more thorough exploration and study of the areas involved.

Brandegee (4) tabulated by families the flora of the Cape Region as known at that time, finding a total of 732 flowering plants and ferns, of which number 146 are confined to the high mountains and 586 to the lowlands. He found that 362 species are common to central and northern Baja California and 494 common to the mainland of Mexico. Out of 390 genera there are 230 which are represented by a single species, indicating a ratio of genera to species similar to that found in island floras. There were four genera and 72 species which appeared to be endemic to the Cape Region as far as known in 1892. An important phase of the floral relationships which Brandegee was not able to touch concerns the number of species on the nearest analagous part of the Mexican mainland which are absent from the Cape District. It is probable that this number is more than twice the total given by Brandegee for the Cape flora.

Owing to the character of the topography there are no extensive areas in the Cape Region with a relatively uniform set of physical conditions. The largest are the plain of La Paz, which lies between that town and the Sierra Laguna, the rolling

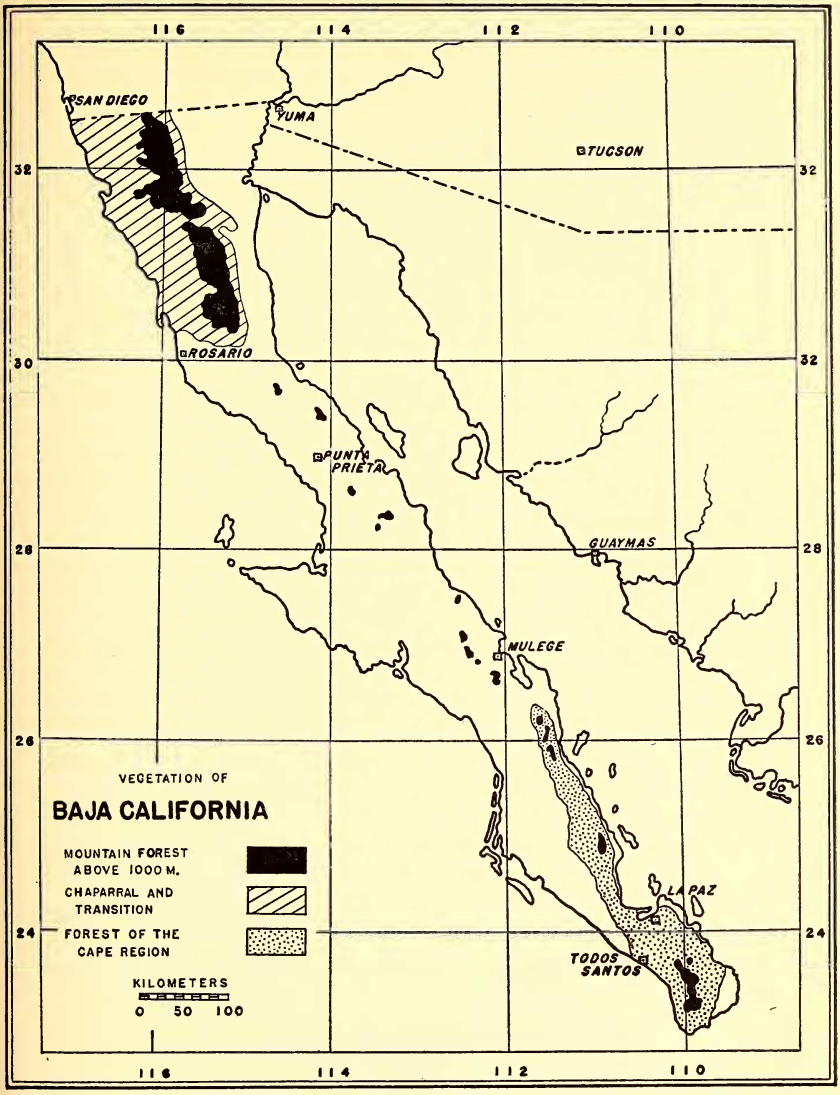

Fig. 1. Vegetation of Baja California.

limestone ridges west of the plain of La Paz, and part of the outwash slope which falls from the eastern base of the Sierra Victoria down to the Bahia de las Palmas. These three areas are representative of the lowland vegetation of the Cape Region. On the Pacific coast south of Todos Santos the vegetation is of a much more xeric stamp. Above 1000 meters the vegetation of the mountains is of a more mesic character.

The bajadas and plains of the Cape Region are either purely

granitic or else of purely volcanic material, the former predominating. The granite soil is a light gray loam which is largely covered by sand in the plain of La Paz and is coarser and more homogeneous on the bajadas immediately east and west of the mountains. There is a poor development of small drainageways, due to the porosity of the soil and the high mobility of the surface. The streams originating high in the mountains have cut deep and abrupt channels midway in their course across the bajadas, and their floods move over a bed with very coarse white sand and remarkably few stones and boulders. The gradient of these arroyos is commonly as great as 1 : 10, and their courses are very direct, free of meanders, islands and relicts of former levels.

The volcanic areas south of La Paz are irregular in their topography and mainly covered by shallow clay soils. Their vegetation below 500 meters is desert and between 500 and 1000 meters is different only in a scattering representation of species from the Cape forest and in a slightly greater density of stand.

The Cape forest below 1000 meters is distinctly xeric. Its height ranges from 6 to 14 meters (19 to 45 feet), and it varies greatly in density, composition and the growth forms which are represented. Certain areas are dominated by slender leguminous trees and others by stout-stemmed trees with low spreading branches. The canopy of the forest is usually open and always extremely irregular. It is rarely that a single species of tree forms as much as 30 per cent of the stand, except in the case of *Jatropha cinerea.* The low interlacing branches of this tree are an obstacle to progress through the forest. In fact an open floor is found only in glades along arroyos where *Lysiloma candida, L. microphylla* and *Cercidium peninsulare* are dominant. Cacti are almost omnipresent, *Pachycereus pecten-aboriginum* being most abundant where the trees are thickest, and *Lemaireocereus Thurberi, Machaerocereus gummosus* and *Opuntia cholla* most common in the open situations. Shrubs are almost invariably abundant and in slightly moist situations contribute to the formation of impenetrable thickets. One of the commonest shrubs is *Tecoma stans,* which has height and stoutness of stem which almost give it the rank of a tree. Several composite shrubs equal the trees in height and their flowers may be seen projecting from the tallest limbs. The commonest of these are *Viguiera tomentosa, V. deltoidea, Alvordia fruticosa* and *Eupatorium sagittatum.* The polygonaceous vine *Antigonon leptopus* is abundant in all but the driest situations and its clusters of brilliant crimson flowers do much to give vivid color to a floral display in which yellow is predominant.

The relatively rich composition of the Cape forest, the close mingling of trees of different height and branching habit, the occurrence of erect compact shrubs, broad poorly branched ones and semi-scandent ones, of cacti, yuccas and vines, gives much of the Cape Region the air of an impoverished tropical jungle.

The vegetation of the Cape Region bears some resemblance to the thorn-forest of Sinaloa (8) in height, density, and many of the growth forms which are to be found. Nowhere is the Cape forest dominated by the thorny acacia type of tree, as is the case in Sinaloa, and it is scarcely appropriate to designate it as "thorn-forest."

The leaves of the trees are mainly compound with small leaflets, but in many of them the leaflets are more than one square centimeter in area. The number of trees with large simple leaves is very small. The seasonal habits of foliage differ widely in some of the common trees. A few of them are evergreen (*Cassia atomaria, Gochnatia arborescens, Sebastiania bilocularis*), a small number are winter deciduous (*Prosopis glandulosa, P. Palmeri*), and a large number are drought deciduous (*Jatropha cinerea, Bursera laxiflora, B. microphylla, Cyrtocarpa edulis, Cercidum sonorae*). Many others are partly deciduous in the dry spring months, the extent of defoliation doubtless depending on the severity of the dryness at that season.

The most common trees and other tall plants in the Cape forest below 1000 meters (3280 feet) are the following:

Lysiloma microphylla
Jatropha cinerea
Cyrtocarpa edulis
Bursera laxiflora
Lysiloma candida
Cercidium peninsulare
Leucaena microcarpa
Cassia atomaria
Pachycereus pecten-aboriginum
Cercidium sonorae
Prosopis Palmeri
Esenbeckia flava
Albizzia occidentalis
Gochnatia arborescens
Haematoxylon brasiletto
Lemaireocereus Thurberi
Sebastiania bilocularis
Bursera microphylla
Pithecolobium tortum
Plumeria acutifolia
Bursera odorata
Yucca sp.

Small trees with soft wood and large shrubs from 2 to 5 meters in height are abundant and very important in contributing to the physiognomy of the vegetation. The most prominent species, including cacti, are the following:

Tecoma stans
Viguiera tomentosa
Karwinskia Humboldtiana
Melochia tomentosa
Mimosa Brandegei
Euphorbia Xanti
Bourreria sonorae
Colubrina glabra
Ruellia californica
Pithecolobium confine
Gossypium Davidsonii
Randia Thurberi
Celosia floribunda
Citharexylum flabellifolium
Lippia formosa
Viguiera deltoidea
Opuntia cholla
Turnera diffusa
Mimosa Xanti
Hypis tephrodes
Alvordia fructicosa
Acacia flexicaulis
Calliandra californica
Fouquieria peninsularis
Machaerocereus gummosus
Opuntia fuliginosa
Randia armata

The approximate distribution of the forest of the Cape region is shown on the accompanying map (fig. 1). On the Pacific coast it extends from sea-level to the borders of the mountain type of forest, found above 1000 meters. A short distance north of Todos Santos it gives way to the low desert scrub which characterizes the outer edge of the Magdalena Plain. On the Gulf Coast it covers all of the granitic outwash and certain favorably located areas of volcanic outwash but is not found on the volcanic hills near the coast south of La Paz. In the Sierra Giganta it occupies the slopes of the mountain on the west and the upper slopes on the arid eastern side. At the northern tip of the Cape forest its occurrence at lower elevations is limited to canyons and broad structural depressions in the lava fields.

The Magdalena Plain and the eastern coastal fringe south of latitude 26° N. are desert in both vegetation and flora. South of La Paz the character of the underlying rock and the derived soils is closely correlated with the distribution of forest and desert. Trustworthy inhabitants state that the east coast receives less rain than the interior as far north as Concepcion Bay, a circumstance which adds to the aridity of the volcanic areas. The Magdalena Plain is like the central region of the peninsula in having little rain at any season. There is some morning fog in April and May, and a narrow coastal strip is visited by strong ocean wind varying in relative humidity from 55 to 65 per cent. The region is distinctly unfavorable to the northward spread of the Cape forest.

The number of plants which are common in the Cape Region but absent from the desert of Baja California is large. The infiltration of the Cape vegetation by desert plants is considerable as to the number of species but only locally important with respect to their role in the vegetation. *Larrea* reaches the top of the southern end of the escarpment but does not descend into the plain of La Paz. *Pachycereus, Lemaireocereus, Cercidium, Bursera* and other genera prominent in the desert are also frequent in the Cape vegetation. Many of the common plants of the desert are abundant on the volcanic areas in the Cape Region but only sparingly represented in the Cape forest. On the volcanic areas the height, spacing, types of plants and other physiognomic features are identical with those of the desert areas far to the north, and the composition of the vegetation is very similar.

Following is a list of the principal desert plants found in dry and open habitats in the Cape forest. A few of these occur in the desert only south of latitude 29° N. The remainder are found nearly throughout the desert of Baja California and some of them occur in southwestern Arizona also. The extent of the northern range is indicated after each species.

Pachycereus Pringlei	B.C.	Brickellia Coulteri	Ariz.
Bursera microphylla	Ariz.	Beloperone californica	Ariz.
Lemaireocereus Thurberi	Ariz.	Opuntia cholla	29° N.

Encelia farinosa	Ariz.	Machaerocereus gummosus	B.C.
Fouquieria peninsularis	29° N.	Calliandra californica	B.C.
Solanum Hindsianum	Ariz.	Franseria magdalenae	29° N.
Trixis californica	Ariz.	Colubrina glabra	29° N.
Franseria ambrosioides	Ariz.	Condalia spathulata	Ariz.
Bursera rhoifolia	B.C.	Simmondsia californica	Ariz.
Pedilanthus macrocarpus	29° N.	Euphorbia tomentulosa	B.C.
Jatropha cinerea	B.C.	Jatropha spathulata	Ariz.

On the level plains of Sonora the desert merges gradually into thorn-forest between latitude 27° and 28° N. In Baja California there is uninterrupted desert as far south as latitude 26° N.; it covers more than half of the peninsula thence south to latitude 24° N., and small areas of it are found almost to the extreme tip. The transition from desert to Cape forest is not a matter of gradual change over many miles so much as the interdigitation of the two over rugged and varied country.

Differences of flora and of vegetation are not of the same kind and are therefore difficult to compare. From a general standpoint, nevertheless, it may be said that the Cape Region and the adjacent mainland differ in vegetation fully as much as in flora. The southern limit of desert is about three degrees further south in Baja California than it is on the mainland. The relationships of the flora of the Cape Region, as far as known, are somewhat closer to Sonora than to Sinaloa. The flora of the mainland, over a comparable area, is much richer than that of the Cape Region, but the vegetation of the lowlands of the Cape is very much more diversified than that of the lowlands of Sinaloa and southern Sonora. In the latter region a single tree is everywhere strongly dominant, and its commonest associates are few as compared with the great variety of arborescent forms in the Cape forest.

Desert Laboratory,
Carnegie Institution of Washington,
Tucson, Arizona, July, 1937.

Bibliography

1. Bryant, W. E. The Cape Region of Baja California. Zoe, 2: 185–201. 1891.
2. Brandegee, T. S. A Collection of Plants from Baja California, 1889. Proc. Cal. Acad. Sci. Ser. 2, 2: 117–232. 1889.
3. ————. Flora of the Cape Region of Baja California. Proc. Cal. Acad. Sci. Ser. 2, 3: 108–182. 1891.
4. ————. The Distribution of the Flora of the Cape Region of Baja California. Zoe, 3: 223–231. 1892.
5. Grinnell, Joseph. A Distributional Summation of the Ornithology of Lower California. Univ. Cal. Publ. Zool. 32: 1–300. 1928.
6. Nelson, Edward W. Lower California and its Natural Resources. Mem. Nat. Acad. Sci. 16. 1921.
7. Shreve, Forrest. Vegetation of the Northwestern Coast of Mexico. Bull. Torr. Bot. Club, 61: 373–380. 1934.
8. ————. Lowland Vegetation of Sinaloa. Bull. Torr. Bot. Club, in press.